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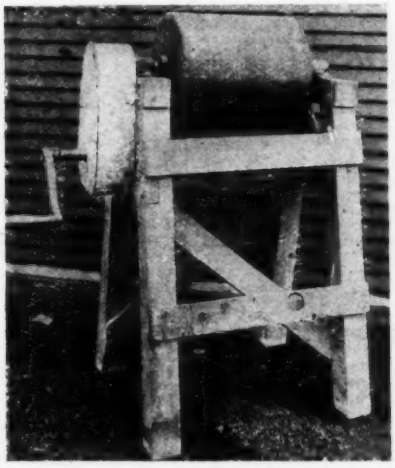
Making Glass for Ford Windshields

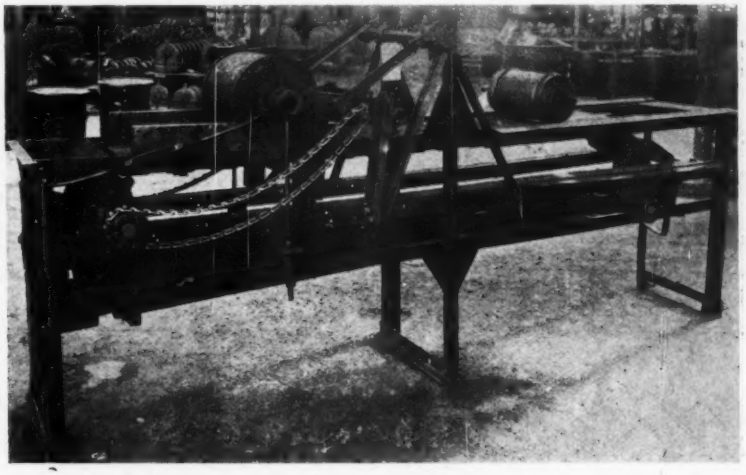
By FRED J. HUNTLEY

It was back in 1919 that the Ford Motor Company experienced difficulty in obtaining, among other things, a sufficient supply of glass for windshields. So the company attacked the problem aggressively as it does everything else that troubles it. It decided to manufacture its own glass.

In looking about, someone suggested the possibility of producing a high grade of plate glass without either grinding or polishing. Such a process as this, if it were possible, would revolutionize the plate glass manufacturing business.



THE ROLLING MACHINE USED IN THE FIRST FORD EXPERIMENTS



ANOTHER MACHINE USED IN EARLY EXPERIMENTS FOR ROLLING PLATE GLASS

The man who suggested the idea was brought into the plant, machinery and other equipment was installed and he was told to go as far as he liked in the way of experiments. He attacked the problem from every conceivable angle. One year passed. Then two years, and while at times the object seemed about to be attained it was never possible to accomplish just what was desired. And to this very day the problem of producing glass of the quality of high grade plate without the grinding and polishing process, is still unsolved. At this time, no one at the Ford plant is attempting further development along that line.

However, the man who experimented for so many months left behind him a big monument to his idea and efforts. Out in the upper yards of the big Ford plant at Highland Park, Detroit, Michigan, there still stand great stacks of cullet—tons and tons of it—developed from the experiments made. As everyone knows, nothing at the Ford plant goes to waste, so a little later on it will be shown that this almost valueless cullet is being utilized in the making of commercial glass.

The Ford Motor Company still wanted plate glass for windshields and was determined to produce it in its own plant. So the company called in its engineers and they started experimenting along lines of their own. Due to the results of previous experiments, it might be well to say, they made no further attempt to draw plate glass direct from the furnace.

The old machinery and equipment—that is, most of it—was cast out and new installed. The latter was largely designed in the Ford plant and is now turning out a high grade of plate glass in such quantities as to meet about seven per cent of the Ford requirements. It is well to add, however, that all of this glass is run through sand and emery grinders and then polished in the regular way.

At present the plant has only one furnace. However, there soon will be in process of construction a new plant in River Rouge, a few miles from Detroit, near the Ford tractor industry; a great modern structure, in which there will be four large glass melting furnaces. This plant probably will not be completed and in operation for a year at least, and perhaps longer. It will be one of the most modern in the country. The contract for the construction of the first furnace has been let to the H. L. Dixon Company of Pittsburgh, glass factory engineers and contractors.

The present glass plant at the main Ford institution in Highland Park has been operating, with a few short periods

FURNACE AND BATCH FEEDING CHUTE NOW IN USE AT THE HIGHLAND PARK PLANT OF THE FORD MOTOR COMPANY

of idleness for repairs and other causes, for about eighteen months and is now producing at the rate of about 1,250,000 square feet of high grade plate glass annually. This, as said before, is about seven per cent of the Ford requirements.

The furnace has been running continuously since October 9. The material fed into it first goes through a batch mixer operated by an electric motor. Each batch is made up of the following proportions:*

Sand	400 lbs.
Limestone	118 "
Soda ash	135 "
Salt cake	24 lbs.
Cullet	150 "
Arsenic	2.5 "
Charcoal	⅓ oz.

A batch goes through the hopper every twenty-five minutes.

The furnace is heated by coke gas manufactured at the Ford plant in River Rouge. Temperatures range from 2,650 to 2,600 degrees.

The molten glass flows from the furnace on to a table of metal plates, passes under revolving rollers of nichrome metal and thence into a lehr 442 feet long, operated by two ten-horse power electric motors. Here the continuously moving strip of glass extending through the entire length of the lehr is gradually cooled from 1,010 degrees to about 80 degrees, and passes on to the cutting table at the end of the lehr where it is divided into pieces about the size of the windshields one sees every day in Ford cars. This is done by one man who stands by equipped with a regular glass cutter. The strips, as they come from the cutting table, are taken to other tables and prepared for the grinding and polishing process. Each piece of glass is first carefully embedded in plaster of paris. While the plaster is becoming sufficiently hard the tables are started along the tracks towards the first grinding machine, where the coarse sand grinding process begins. As each table passes to the grinding device it comes in contact with a chain which conveys it under the grinder, which is equipped with a rapidly mov-

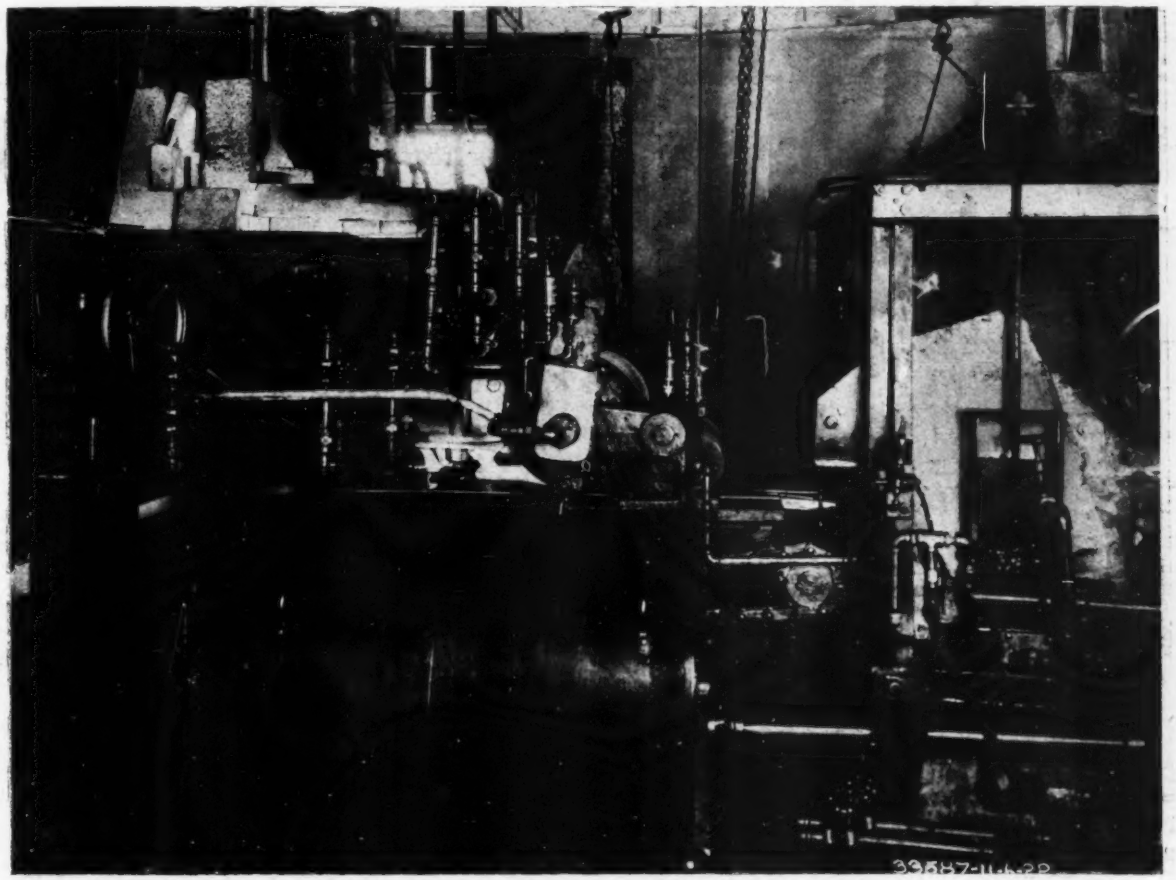
*EDITORIAL NOTE—The composition of the glass, calculated from the batch, and assuming the raw materials to be pure, is:

	Per Cent
Silica	72.00
Sodium oxide	16.12
Calcium oxide	11.88
Total	100.00

ing disc on to which the sand flows and is distributed over the surface of the glass by centrifugal force.

There are seven grades of sand used, one following the other. Into each group of the machines a different grade of sand is fed, the tables on which the glass rests passing in turn from one machine to the other. As said before, the first machine is devoted to the coarse sand. Then follow in succession the other grades. The sand, as it passes over the glass, comes in contact, of course with water. In this solution it flows off into a gutter where it passes into a pit located in another part of the building. Here it is taken up by a pump and deposited in a grading tank.

At the end of the seventh grade the glass passes through another cleansing process whereby it is freed of all sand or particles of dust. This process is very thorough in order to eliminate any substance that might mar the glass while going through the next process. The tables then pass on to the emery grinding. These machines are similar to the sand grinding machines. But only five grades of abrasive are used, instead of seven as in the sand grinding process. Each two machines carry different grades of emery—first coarse, then fine. It is fed into the machines exactly like the sand, centrifugal force distributing it over the glass. Then with the water it flows into the gutter, and from the gutter it goes



THE FORD CONTINUOUS GLASS ROLLING MACHINE IN OPERATION. THE MOLTEN GLASS FLOWS DIRECTLY FROM THE FURNACE, PASSES UNDER THE ROLLERS AND THROUGH A 442-FOOT LEHR

As has been intimated before, nothing goes to waste in the Ford plant. So it is with the sand. Here at the tank it is separated into seven sizes which later find their way back to their separate grinding devices where they again go through the process just described. The sand is all reclaimed with the exception of one grade which is too fine for use in any of the different grinding stages.

Between each of the groups of grinding machines is placed a washer, or scrubber, as it is sometimes called, which cleanses the glass of all sand or foreign substances that may by chance get onto the surface of the glass.

The tables pass from one grade of sand to the next, and so on until the sand grinding process is completed.

to the pit and from there is pumped into a tank, graded like the sand, and used over again.

After passing through five grades of emery grinding, the glass again is thoroughly cleansed and inspected for defects. Still on the tables and embedded in the plaster of paris, the plates of glass are then moved to the polishing machines where the rouge is applied by means of a light spindle, the rouge being supplied through an electrically controlled valve.

This device was designed by Ford engineers. The hand device by which the polishing head is lowered is a regulation Ford steering wheel. Used in connection with the drive of this machine is a Ford worm gear, so familiar on Ford tractors. The power comes from a 15 h.p. electric motor.

The glass, after passing through the polishing process, is then cleaned and taken from the tables.

It must be remembered that thus far the glass has been ground and polished only on one side. As each sheet is taken from the table it is turned and deposited on another table, where, as before, it is embedded in plaster of paris. Then the tables, with the glass on them, are started through the line of sand grinders again, going through the process just described. The line is kept in continuous operation and when the glass passes out after it has been ground and polished on both sides it is ready for use.

It might be well to add that the plaster of paris mixing machines also are a creation of the Ford engineers, and are so constructed that the operating machinery is kept free from encrustation at all times. The machinery used for crushing the emery, like the other, is of Ford design, the big crushing wheel weighing about 3,000 pounds.

The Ford glass plant has a distinct laboratory of its own, separate from any other on the premises. It is located directly north of the main plant and it is here that samples of the glass are taken from time to time and tested. The laboratory is complete in every way and is operated, of course, by a technical expert.

Thus it will be seen that Henry Ford is a glass manufacturer as well as an automobile manufacturer, a railroad operator, a coal mine operator, a maker of steel, and of farm tractors. All these activities with the exception of those concerning the farm tractor, it should be remembered, are necessary in the production of the automobile.

Although the Ford glass plant employs at present about 180 men it is, as shown before, producing about seven per cent of the company's requirements, and consequently is a very important factor in the organization. It is not always possible to obtain glass from outside sources sufficient for Ford requirements and it is then that the full value of the glass plant is realized. On the day the writer visited the plant, he was informed that the only glass obtainable at that time was that of the Ford Company's own production.

With the big new plant in prospect, it will be seen that the company is only just starting in the glass manufacturing business. Experiments are in progress all the time. This will mean new and still better methods of making glass.

FORD GLASS GRINDING MACHINES

The Use of Fuel Oil for Finishing Glassware

By W. S. EDMONDS*

In recent years a large number of glass manufacturers have gone through the experience of using fuel oil for finishing glassware, being forced to go to great expense due to the fact that some substitute had to be found in the place of

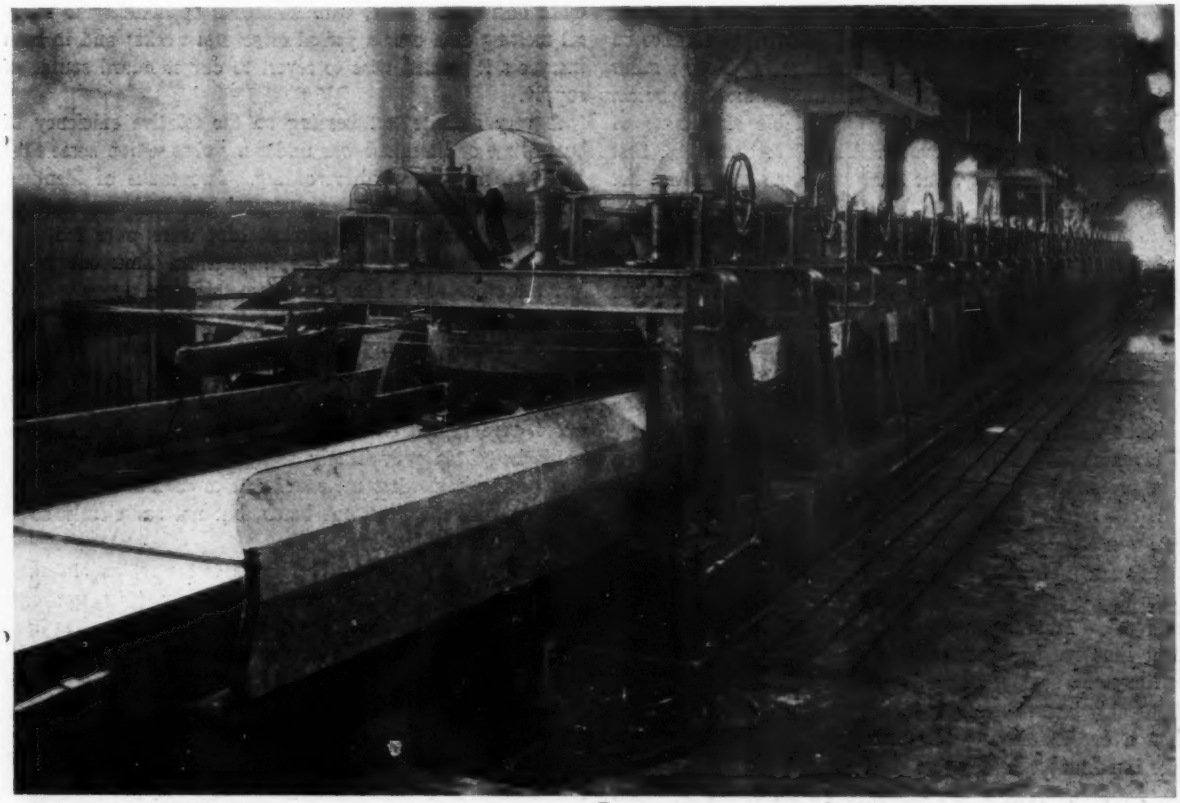
* John Foerst & Sons, Bayonne, N. J.

natural gas. For the benefit of those who are using fuel oil, or may have to use it in the future, the following experiences are related, which have proven that the work can be done with satisfaction and economy.

Some manufacturers have thought that all that was needed was to put the oil burners in the glory holes where the gas burners were used, to turn on the steam or compressed air and to regulate the amount of fuel oil until they obtained a flame of what they believed to be the proper intensity. This is where they made a mistake, as the operation of fuel oil must be right in order to get the same amount of heat units as are obtained by using gas. The kind of fuel oil burners used for finishing glassware in the glory hole must be selected with reference to the size of the glory hole and to the kind of glassware.

The next thing to decide is the amount of pressure required for the burner, and whether steam or compressed air should be chosen. The feed lines should be large enough to give a steady supply of fuel oil. This also applies to the steam or compressed air lines. Satisfactory results should be obtained by using one and a half inch pipes for both, reduced to the size of the openings of the fuel oil burners. Compressed air is preferable to steam, since air can be obtained carrying very little moisture. A dry flame of fuel oil will give the best combustion and will permit the carbon in the fuel oil flame to give a polish to the glass. As is well known, the use of carbon tools by the finisher will give glassware a fine polish.

The burner should be set in the center, and as near as possible at the bottom of the glory hole, where it can be reached easily. The flame should start at the point of opening of the burner, and spread until it reaches the place where the glassware is to be finished. It is not advisable to have the flame in the center of the glory hole and to expect the heat from the walls and crown to heat the glass to the proper point for finishing. If this is done more oil is used than is necessary, and heat will be passing out the stack. It is important to have a damper on the stack which can be set so as to regulate the draft, drawing in just enough air for complete combustion. Sometimes it has been found that burners were not considered to work right unless smoke could be seen leaving the stack. Others believe that there should be no smoke. It will be found that oil burners are working to the best advantage and with the greatest economy if the burners are adjusted and the damper set in such a way that there is just a showing of very little white smoke leaving the stack. The opening at the bottom of the glory hole should not be any larger than is needed. Fuel oil burners do not require a great deal of draft passing in at the point where the burner operates. Some have the mistaken idea that the opening must be large. If these suggestions are followed by those who are using oil, and if the oil meter is watched before and after making changes in the method of operation, it will be seen how great a saving of fuel is effected and how much better results and better utilization of heat units are obtained.



FORD GLASS POLISHING MACHINES

Burnt Lime or Limestone

Some Random Observations

By IRVING E. ADAMS*

In the manufacture of polished plate glass limestone is universally used, usually in the proportion of 320-350 pounds to 1,000 pounds of sand. A preference is discernible among superintendents of such plants for a high calcium stone. There seems to be little argument for the use of burnt lime here. It would have to make as good glass in less time, or better glass in the same time to overcome the higher first cost. A test conducted by the writer, and perhaps duplicated by others, is interesting. We placed a twenty-pot furnace on a burnt lime basis for a period of three weeks. Four similar furnaces were working with the standard limestone batch. The results were negative. No appreciable shortening of the melting time was observable. The glass seemed at first of slightly better quality, but final wareroom reports did not justify any optimism.

Another test of passing interest made at the same time, confirmed the wisdom of manufacturers in using sixty (60) to seventy (70) pounds of salt-cake per batch, for a straight soda-ash burnt lime charge, failed in four melts on two pots to finish in any commercially reasonable time.

In the window glass industry, limestone is also generally used. Its low cost, the demonstrated fusibility of "limestone salt-cake" mixtures, and the large melting areas involved, all favor its use. Here again a high calcium limestone seems to be preferred, especially in machine operated plants.

In other branches of the glass industry the situation is more complex. Burnt lime is very generally, though not exclusively, used in the production of flint glass bottles and blown and pressed tank ware. Green glass bottles are sometimes made from a limestone, and at other times from a burnt lime batch. Manufacturers of green glass fruit jars use limestone, as do most producers of tank made amber ware.

Probably burnt lime is, in most instances, given precedence when a decolorizing agent is employed, when quality is a more important consideration than cost, and when the melting area is restricted and tonnage requirements severe. This last statement regarding relative melting efficiency is open to some comment, as I shall attempt to show. Another general statement might be to the effect that most users of burnt lime prefer the high magnesia variety.

The amounts of lime or limestone ordinarily used per one thousand (1,000) pounds of sand vary as follows:

	Burnt Lime	Limestone
Milk Bottles	120 lbs.	
Flint Bottles in general	110 "	
Pressed Tumblers	100 "	
Blown Tumblers	95 "	
Lamps, Chimneys, Vases	90 "	
Large Blown Objects	75 "	
Fruit Jars		180 lbs.
Green Bottles	110 "	200 "
Polished Plate		330 "
Window Glass		360 "

Perhaps the statement that users of burnt lime prefer the high magnesia variety is a little far-fetched. Yet the very extensive use over many years by manufacturers of the well-known northern Ohio deposits would seem to bear it out. The uniform purity of these deposits, the care exercised in burning and pulverizing, and the splendid service rendered by the producers might partially explain their popularity; but, if my own experience is of any value, there is a deeper reason based on composition. On two occasions I have been accorded the privilege of turning tanks over to a high calcium burnt lime basis, with abundant opportunity to study all melting data over a period of several weeks; and in both instances it seemed wise to revert to our standard source of supply.

A very definite test bearing on the relative efficiency of burnt lime or limestone was under my observation some time ago, and may be worth recording. Two tanks of identical melting end dimensions, both natural gas fired, and making the same general line of pressed flint ware were fed, one with a coarsely crushed high magnesium limestone batch and the other with burnt lime from the same deposit. Both tanks were called upon to melt a ton of glass to ten (10) square feet of melting end surface, both were decolorized with selenium, and both were supplied with the same soda ash and cullet proportions. At the end of five weeks both tanks were placed on a burnt lime basis, as the limestone batch had been prevailingly seedy throughout the test. It had proven somewhat more difficult to maintain regularity of color with the limestone batch, but not sufficiently so to influence the decision.

The limestone used in the above test was, as stated, a coarsely crushed product. Probably thirty (30) per cent would have failed to pass a four-mesh sieve. This has been generally true of the bulk of the limestone supplied to the glass trade. That the degree of fineness to which the stone is reduced has an important bearing on melting efficiency has been brought home to me in several unrelated instances. In a polished plate factory, we substituted a coarsely crushed limestone with a finely pulverized equivalent from the same source primarily to promote more thorough mixing of the batch materials in a mechanical "filling in" machine. It made a noticeably faster batch from a melting standpoint.

Again, in a factory making large hand-blown objects, and using a very pure limestone reduced to a condition of almost impalpable fineness, no improvement was discernible as regards seed by changing to a burnt lime batch.

Another interesting case came to my attention recently. A manufacturer of green glass bottles, using a finely pulverized limestone, but with an iron oxide content of nearly one per cent, changed over to burnt lime with the object in view of attaining a less disagreeable shade of green in the finished product. The color came better in due time, but contrary to expectation, failed to show any improvement in tonnage of plain glass melted.

Regardless of any significance that may be attached to the illustrations just given, there is certainly no noticeable trend away from a burnt lime basis in those fields where it has become standard practice.

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Modern Glass Factory Equipment

THIRD ARTICLE

By W. S. MAYERS*

Batch Mixing and Conveying Equipment

For pot furnaces and small tank furnaces for blown ware expensive batch mixing and conveying systems are usually not justifiable on account of the small tonnage requirements, and pot furnaces especially present great difficulties in the matter of mechanical batch distribution. However, where several small tonnage tank furnaces are conveniently grouped mechanical systems of moderate cost may be well worth while. Hand mixing, if properly done, gives just as good results as machine mixing but it is a laborious operation and the chances for a thorough mixing of the batch ingredients are very largely in favor of the machine mixer.

In large plants where the production consists of window glass, bottles, fruit and packing jars and all sorts of heavy pressed ware, hand mixing and conveying have long since been discarded and replaced by mechanical installations of various designs.

Various appliances for weighing and mixing are in use, some with non-portable mixing drums discharging into elevators or conveyors and to which the batch materials are carried in cars or weigh-baskets with built-in scales, or simple hopper cars passing over platform scales and others wherein the weighing, mixing and transporting operations are combined in a single car which receives the materials from three or more bins and discharges into one or more track hoppers.

The mixers are usually of the rotary type and are adaptations of the well-known concrete mixers, the requirements being that the drums have capacities ranging from 1 to 4 tons and that the materials are received through and discharged from gates on the peripheries of the drums.

The scales carried by the mixing car are preferably of the multiple beam type in which each beam has a slider in a set position corresponding to the desired weight of the batch ingredient to which it is assigned, and with adjustments providing for the accurate determination of the weight of each ingredient from its respective beam regardless of the weights of any preceding charge.

The combination weighing and mixing cars are usually electrically operated from trolley attachments and have one motor for propelling the car and another for rotating the drum, both operations being done simultaneously or separately, as desired.

Decolorizers and other small volume ingredients are invariably placed in the mixing drum by hand.

Storing Raw Materials

In practically all modern factories mechanical appliances have been installed both for unloading and storing the raw materials and for distributing the mixed batch to the various furnaces.

Power shovels are in general use for discharging material from box cars into hoppers placed at the car doors, and from these hoppers the material is carried by elevators or skip hoists to the storage bins. Where the conditions are favorable probably the best equipment for this use consists of a combined traveling hopper and elevator running upon a single rail between the railroad siding and the row of bins, and upon a second rail located near the tops of the bins. From the elevator head at a considerable elevation above the bins, a fixed spout extends to the center line of the bins and into the openings at their tops. It is necessary, of course, to spot both the elevator and railroad car in exact places opposite each bin.

Where track locations and overhead obstructions do not permit the use of the traveling hopper and elevator they are fixed at some convenient point in working relations to the cars and bins. This layout requires a distributing conveyor of some sort to carry the material from the fixed elevator spout to any one of the bins selected, and for this purpose almost any of the commercial types of conveyors may be adopted. Where the elevator may be located at or near the center of the row of bins the most satisfactory and least expensive equipment for this service consists of a shuttle belt conveyor with an overall length of about 2 feet less than half the distance between the centers of the first and last bin. This conveyor is mounted on a flanged wheel truck and track straddling the bin openings and must be reversible so that it may receive raw material at any point on its upper run and discharge at either end. The truck should be propelled by the motor which drives the conveyor and the spout from the elevator must be bifurcated with a two way valve over and in line with the belt. This equipment requires an adequate gallery built full length of the row of bins.

When there are only two or three storage bins a considerable saving in cost may be effected by locating the elevator at the center and extending it to a sufficient height to permit the spouting of the material directly to each bin, using two or three way valves, as the case may be, at the elevator head. All outside spouting must be watertight and should be made of not less than 10 gauge, or better still 8 gauge plate, to prolong its life under the scouring action of the sand.

Batch Conveyors

There are many designs of batch conveyors built to meet the varying conditions in plants which at first had only hand appliances. These need not be considered as types and only some of the later full mechanical installations with overhead bins and traveling mixing and weighing cars will be discussed under this head.

There are in general three distinct systems for conveying the mixed batch to the furnaces; first, the batch car running under elevated bins and discharging directly into furnace bins; second, the batch car running under the storage bins at or near ground level and discharging into elevators at each furnace and third, the car running under the bins at any level and discharging into an elevating and conveying system extending to the furnace bins. The system first named

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requires very heavy and expensive substructure to support the bins and batch car, as well as higher elevators, and has little to recommend it.

The second named layout requires no galleries nor other structural work and upon level ground with a basement under the factory floor it may prove to be desirable. It requires a track hopper, elevator and pit and conveyor at each furnace and makes an objectionable amount of dust when the track is on the furnace floor level. With the car in the basement under the filling floor, the interference with the reversing valves and possibly the producer piping may rule it out.

The third named system will be found adaptable to almost any factory layout on account of its flexibility and non-interference with other installations. Its component parts may be described in general as follows:

From the track hopper under the storage bins the batch is carried to the elevator boot by a short screw conveyor with dust tight casing, and from the elevator to the various furnace bins a belt conveyor with a traveling tripper gives excellent service with minimum costs in installation and up-keep. A light gallery is required for the belt conveyor directly over or slightly to one side of the furnace bins with spouts to each bin. If this gallery is constructed dust tight there is no possibility of dust getting into the furnace room.

This system also has the advantage of increasing the daily output of the weighing and mixing car as it has only the length of the tunnel under the bins to travel. A further

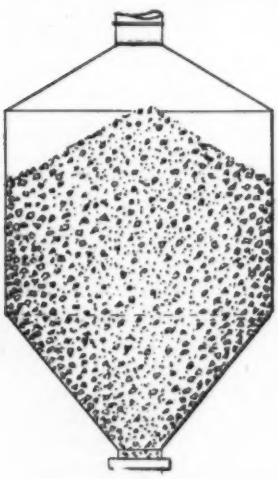

FIG. 1

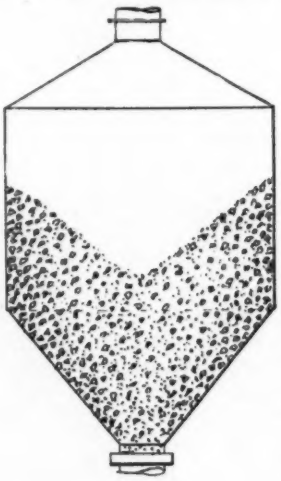

FIG. 2

advantage lies in the fact that branch overhead belt conveyors leading to irregularly located furnaces may be fed from the main conveyor at any point.

Furnace Bins

These are almost invariably constructed of steel plate with a capacity of about 24 hours' supply, and are located from 8 to 20 feet above the furnace dog-house and are covered dust tight. They should have hopper bottoms with gates and spouts leading directly over and to within a few inches of the metal line in the dog-house.

These bins are made rectangular, cylindrical and sometimes irregular in shape, and are either suspended from heavy frame work or are supported by columns attached to their bodies. If of the latter type care must be taken to avoid substructure bracing which would interfere with manual operations by the furnace man.

As compared with the rectangular type the cylindrical bins are superior in that they have greater capacities with the same weight of metal and require no stiffening ribs nor internal tie rods.

We now reach a phase of the discussion in reference to furnace bins which has no bearing upon their size, design or location; that is, the question of the segregation of the materials composing the batch during its deposit in the bin.

When material in bulk such as crushed stone of assorted sizes, run of mine coal, etc., are piled from a single spout or chute the pile is always conical in form and the greater part of the large lumps roll to the bottom edges while the central part and apex of the cone are composed largely of finer material.

Tests show that to some extent a like condition exists when a mixed batch is deposited in the bins, the coarse grains flowing to the outside and the finely pulverized mate-

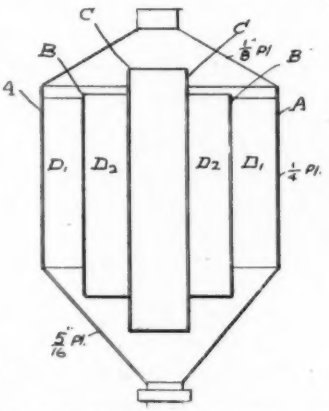

FIG. 3—VERTICAL SECTION

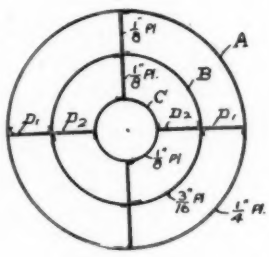

FIG. 4 HORIZONTAL SECTION

rials adhering to the central part of the pile as is shown roughly in Fig. 2. When the soda ash or decolorizer contains large grains or is lumpy, as is often the case, these large grains will collect near the outside of the bin, giving the batch mixture an excess of soda ash at this point and a deficiency near the center.

Now when the material flows through the gate at the bottom it is well known that the whole mass does not descend in the structure which it assumed when deposited, but that the central portion descends first leaving the upper surface in the form of an inverted cone as shown in Fig. 3. Under this condition it is to be expected that the first part of the batch drawn out will be composed of the finer grains in the mixture. Remixing will take place to some extent during the discharge of the bin but it will be far from adequate.

As a means of overcoming this adverse condition the writer suggests that the steel plate cylinders B and C in Figs. 4 and 5 be inserted concentric with the bin walls A and braced by the vertical radial steel plates D1 and D2.

In the narrow annular spaces there can be no wide segregation of the coarse from the fine materials, as shown in Fig. 2, and the tendency to remix will be much greater than in the ordinary open bin.

Opportunity for an American Glass Training School

By WM. M. CLARK*

The plan of the Glass Trade School in Zwiesel, Bavaria, is a method of education which some American educational institutions could well emulate and develop to the benefit of the American glass industry and supply a well rounded training for youths to be more thoroughly prepared and fitted for positions in the glass plants of this country.

Primarily the intention is to take students of over sixteen years of age who have had a grammar school education and either spent some time in a high school or several years working in a glass works. The regular course is either three or four years before they are graduated. But they also accept older persons who wish to supplement their practical experience by studying special subjects. Also chemists and engineers who wish to specialize in glass manufacturing are received during the Summer School.

The technical glass course is designed for the preparation of managers, superintendents, furnace men, technical executives, fuel engineers, chemists, decorators, designers, foremen and all positions of responsibility about a glass works.

This year the term will be only seven months long. Some of the subjects taught are the chemistry of glass making, a knowledge of the raw materials used; coloring and decolorizing agents; changes that take place in melting glass, with calculations and experiments; investigation of the composition of glasses and computing glasses; studies regarding the whole process of fusion and cause of defects, such as cords, waves, stones, blisters; conditions favoring good and poor furnace operation.

Then the study of fuels and methods of firing and methods for conservation of fuel and preventing heat losses is gone into in considerable detail. Coal, oil and gas firing are discussed. Types of fire boxes, burners and gas producers are studied and compared. The heat values and applications of the various fuels are taken up. Pyrometry and the use of pyrometers.

Both the theoretical and practical reasons for what is considered good practice and what is wasteful practice are discussed from different standpoints of economy and expediency.

Courses are also given in decorating glassware, such as cutting, engraving, etching and painting and these features are gone into from the technical as well as the artistic side so that the student acquires a fundamental knowledge of the materials and equipment with which he works as well as the technique of the art. Drawing, both free hand and mechanical, is stressed. Those of artistic temperament have their skill developed in the matter of designs and decoration, but have the characteristics of glass so impressed upon them that their artistic efforts have a practical application as related to glass and are not unsuitable for this material. The mechanical drawing features glass house equipment as well as mold design.

The art courses cover hand decoration, painting, etching, metal deposition, casing, work with enamels, surface colorations and the whole field of matters relating to art ware.

The intention is to give a student a broader knowledge of the fundamental material factors that enter into the glass industry. It is recognized that such training cannot supplant practical experience, but must serve as a preparation for later work. However, it is found that foremen who have had such a broader preliminary training develop faster than those who have not had such opportunities and possibly one of the best recommendations for the school is that the graduates are in great demand among European glass factories.

The method of instruction followed is more one of individual coaching and teaching a man to think about what he is doing and the reasons for the best way of performing operations, than one of group instruction.

Possibly there are also some economic features which it would also be desirable to incorporate in any American school which planned an intensive training for glass specialists. The desirability of standardization of output, capital requirements for fixed and working capital, turnover of capital, matters regarding costs of capital, costs of production, costs of distribution and profit. Questions of supply and demand. Balancing up seasonal demands by interposing production of staple articles. Planning and routing production, purchasing and sales policies, publicity, export trade, consumption of glassware, idle investment, depreciation, extension of markets, patent protection, maintenance and selling prices as related to manufacturing costs and to competition are a few of the business subjects which might be considered.

In former days lawyers never had much school training, but studied in some established office or read law until they were ready to take the bar examinations. This system produced some of the most brilliant lawyers that this country has ever known. However, today this system has been almost entirely supplanted by the law schools which have doubtless raised the standard of knowledge of the subject among the average men and given the exceptional man additional advantages of a well rounded training over the old system. Similar conditions held in many of the other professions and trades where practical experience was the only method of instruction before more systematic courses of teaching were evolved.

Therefore it is easily conceivable that a sound training school or course to prepare men for the glass industry would develop a type of men who would be better prepared and keener to take advantage of opportunities in the business and to assure stability and a profitable return upon the investment and strengthen the personnel of the organizations by whom they are employed.

*Glass Technology Department, National Lamp Works of General Electric Company, Cleveland, O.

Glass for Biological Products

The Bureau of Standards is collecting information from the Army, Navy, the Biological Survey, the Public Health Service, and manufacturers of biological products concerning the requirements of glass for this purpose and the desirability of preparing standard specifications covering the same.

The Laboratory

By J. B. KRAK

Notes on Glass Etching

Glass can be etched in two ways, namely, clear etching and frosted etching. Both methods are used extensively in decorating glassware. Window glass used in the interior of buildings is often decorated with elaborate designs, by means of the etching process. Much of this work is done at the present time by the use of the sand blast, which gives an effect quite similar to etching. The delicate shadings which can be obtained by the etching process cannot be duplicated with the sand blast and for high grade work etching is preferred.

As is well known, glass is covered with a protective coat of wax before dipping it into the etching solution. The design is engraved through the wax coating and the glass is attacked by the acid only in those places where the wax has been removed. Large pieces of glass such as window panes are first covered with an asphalt wax upon which a film of tin foil is placed, which sticks to the wax. The figures to be etched are laid out on the tin foil by means of stencils. The figures are cut out with a sharp knife to expose the surface of the glass, which is finally cleaned with oil of turpentine to remove every trace of wax remaining on the glass surface.

Tableware of the less expensive type is often decorated as follows: After dipping the ware in wax it is placed in a metal holder. A needle moving mechanically in the shape of a design is made to move over the surface of the object, while the latter is slowly revolving around its axis. Glassware is stored in a dust-proof room until ready for the etching bath.

Etching can be done in two ways: First, by the use of hydrofluoric acid, either as a gas or in water solution; and second, by the use of hydrofluoric acid salts from which the acid is liberated by adding sulphuric, hydrochloric or acitic acid. Conditions which affect the etching process are:

(1) The composition of the glass.
(2) The concentration of the acid.
(3) The time of exposure.
(4) The temperature.

(1) The composition of the glass. It has been found by experience that potash-lead glasses are the most sensitive to etching. Then follows semi-crystal glass, in which part of the lead has been replaced by calcium, then soda-lime glass and finally potash-lime glass.

(2) The concentration of the acid. The speed of the etching is directly proportionate to the concentration of the acid.

(3) The time of exposure. The intensity of the etching is proportionate to the time of exposure.

(4) The temperature. The speed and intensity of the etching are proportionate to the temperature. In practice most of the work is done at about 20° C. but sometimes, when dilute solutions are used, the temperature is raised to 30-40° C. by leading live steam into the bath.

By the proper application of the four factors which enter into the process, it is possible to use acid of almost any concentration and to obtain any desired effect. Much depends on the skill and judgment of the operator. When results are not as expected the tendency on the part of the man in charge is to blame the materials rather than his own judgment. Although the materials are sometimes to blame, in the majority of cases trouble is due to some mistake made in compounding the solution.

In order to watch the process, pieces of glass having the same composition as the ware, and covered with wax, which is removed in strips, are lowered into the bath at convenient places. They are removed from time to time to study the progress of the etching.

Clear etchings are obtained by using dilute solutions, either of hydrofluoric acid or of its salts. In the latter case acid is added. If the surface becomes frosted, it is rubbed with a specially prepared brush which removes the crystals. A frosted surface can be made transparent by dipping the glass into a more dilute solution.

Dilute solutions are also used to remove the dull effect caused by the wheel of the glass cutter, if a transparent surface is desired.

A frosted etching can be obtained by the use of concentrated solutions. The effect is increased by adding neutral salts. Frosted etchings are also made by exposing the glass to gaseous hydrofluoric acid. The latter procedure, while excellent to produce small etchings is not well adapted to the manufacture of large objects, having considerable surface to be etched, as it is impossible to obtain uniformity. This is due to the fact that water is formed by the etching process, which condenses in small drops. These drops dissolve gaseous hydrofluoric acid and in time dissolve the crystals formed in the surface of the glass.

Moreover, the use of gaseous hydrofluoric acid is dangerous to the health of the workmen and its use is gradually being abandoned.

The following recipes giving a frosted etching have been found useful in practice:

I.	Water	1,000 cc.
	Acid potassium fluoride (HF KF)	250 gr.
	Hydrochloric acid (Sp. gr. 1.18)	250 gr.
	Potassium sulphate	140 gr.
II.	Water	500 cc.
	Ammonium fluoride	500 gr.
	Ammonium sulphate	50 gr.
	Sulphuric acid (Sp. gr. 1.8)	100 gr.

Solution II should etch glass in about five minutes. The action can be increased by adding small amounts of 40 per

cent HF, up to 100 grams. The fineness of the etching increases with the acidity of the bath. For slower work the following formula is used:

III.	Water	1,000 cc.
	Ammonium fluoride	120 gr.
	Sulphuric acid	100 gr.

The speed may be increased by heating to 40 to 50 deg. C.

IV.	Water	1,000 cc.
	Acid sodium fluoride	40 gr.
	Glacial acetic acid	50 gr.

The action of hydrofluoric acid on glass may be interpreted as follows:

If the acid comes in contact with glass, the latter is decomposed. Silica combines with the acid to form hydrofluosilicic acid:

$$2SiO_2 + 12HF = 2H_2 SiF_6 + 4H_2O \qquad (1)$$

The metals present in the glass combine with the hydrofluosilicic acid to form fluosilicates:

$$2H_2SiF_6 + Na_2O + CaO = Na_2SiF_6 + CaSiF_6 + 2H_2O \qquad (2)$$

The hydrofluosilicic acid which is not combined is decomposed, forming silicon tetrafluoride and water:

$$4SiO_2 + 16HF = 4SiF_4 + 8H_2O \qquad (3)$$

Combining (1), (2) and (3) we have:

$$Na_2OCaO6SiO_2 + 28HF = Na_2SiF_6 + CaSiF_6 + 4SiF_4 + 14H_2O$$

The theory that the frosted effect is due to the formation of fluosilicates has been confirmed by a miscroscopic study of etched glass by Reinitzer[1]. Fluosilicates are insoluble in concentrated solutions, but are soluble to some extent in dilute acid solutions. This explains why clear etchings can be obtained by diluting solutions. The addition of certain salts decreases the solubility of fluosilicates. This tendency is especially marked in the case of ammonium salts as is observed from the quick results obtained by the use of ammonium fluoride or better still the acid salt NH_4HF_2.

Chimneys*

The chimneys of furnaces should be so designed as to relieve the furnace of the products of combustion as rapidly as formed and maintain thereby an equilibration of pressure therein. This service must lie between two extremes, both of which tend to evil results, and may be termed insufficient and over-ventilation.

From the first, the accumulation of inert gases in the furnace form a back pressure or damper upon combustion, and retard the reliability of combustion and the efficiency of the furnace.

Upon the second, or over-ventilation, the tendency is either to draw in an excess of air through any apertures, fissures, or cracks which may exist, and thereby reduce the temperature of the furnace, or it may carry the products of combustion away from the flame with such rapidity that there is not sufficient time contact between these products and the contents of the furnace, the mufflers, or reverberators, with the result that their sensible heat is not absorbed and escapes unused into the atmosphere.

The net loss of this latter is of course less in the case of recuperators or regenerators where it is possible to recover a portion of this heat, but naturally the efficiency of such apparatus in the cycle is lower than the direct contact of the hot gases to the object to be heated.

The rate of flow of the products of combustion varies and it is usually a function of temperature where natural gas is used. In small house chimneys it is frequently as low as 3 to 4 ft. per second. In that of boiler chimneys from 6 to 15 ft. per second, while in furnace chimneys as high as from 10 to 20 ft. per second. The temperature of the first will probably lie between 100 and 200 degrees C. (212 deg. to 392 deg. F.), the second class between 100 to 300 deg. C. (212 to 572 deg. F.), and in the last between 300 to 1000 deg. C. (572 to 1832 deg F.).

There are many more or less intricate formula for calculating the size and height of chimneys, but as a practical consideration it must be borne in mind that the pull or suction of a chimney is purely a matter of equilibrium between the weight of a column of hot gases and the weight of an equal column of air at atmospheric temperature. If the volume of the one, multiplied by its specific gravity at its average temperature, giving its weight be subtracted from that of the other at atmospheric temperature, the difference will represent the amount of pressure or pull exerted over the area or cross-section of the chimney. This will represent the total head from which, for practical purposes, must be subtracted the velocity head and the friction head, the remainder equaling the net or available head.

The formula given by Richards in his "Metallurgical Calculations" for the head of gases in the chimney due to their heated condition in terms of external air, is in English units:

$$h^0 = H\left[\frac{1 - D + {}^1/_{491}[(t-32) - D\,(t'-32)]}{[1 + {}^1/_{491}(t'-32)]\;[1 + {}^1/_{491}(t'-32)]}\right]$$

h^0 equals total head of air in ft., at 32 deg. F.
H equals height of chimney in ft.
t equals temperature in chimney.
t′ equals temperature of air outside.
D equals specific gravity of chimney gas, air=1.

Friction head may be said to be a function of the roughness of the walls and has been empirically determined to be about 1-40 H. It can be expressed in the formula.

$$h(\text{friction}) \text{ equals } 1.9\text{—}K, \frac{H}{d}$$

where K is 0.05 for a smooth interior, to 0.12 for a rough one, the average being 0.08 and d the diameter or side of square section.

The above equations are given merely to show the basis for calculation in ascertaining ventilation. For all practical purposes, tables are sufficiently accurate for purposes of practice, and they may be checked by calculating along the lines above indicated.

About 150 ft. represents the practical maximum height of chimneys; for greater capacity, chimneys in multiple should be used.

[1] Ber. Oest. Chem. Ges., 1886, p. 67. Wagner's Jahresber., 1886, pp. 533-537.

*From "Double S Fax," issued by The Sharp-Schurtz Company.

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"The greatest thing a man can do is to see something new, and then tell it to other men, clearly and without fear."—Ruskin.

The German Society of Glass Technology

The news of the formation of the German Society of Glass Technology is a cause of satisfaction to those who have the best interests in mind of the glass industry and glass science. When in November, 1916, the Society of Glass Technology was organized in Sheffield, England, no one could have foreseen the beneficial influence which this Society has demonstrated, not only on the glass industry of the British Empire but also on that of the other English-speaking countries. It is conceded that this quickening effect is due to a combination of initiative, leadership and scientific attainment on the part of the guiding spirits of this organization which would be difficult to equal.

In view of the great results which have been obtained by the Germanic countries both in purely scientific research and in the field of applied science, it may be confidently expected that the organization of the German Society of Glass Technology will prove to be as important an event as that which happened six years ago in Great Britain.

That the crushing defeat of our late enemies has not left them broken in spirit and has even strengthened their desire to excel in those fields of endeavor for which they are so well adapted is decidedly a matter of satisfaction to Americans who desire nothing better than a speedy reconstruction of Europe.

The problems of the glass industry are so numerous, the secrets to be fathomed are so deep that it is impossible to expect any one nation to produce enough men of genius capable to solve them all. Every country and race has its own cast of mind and attacks problems in its own way. The German engineer and scientist has a high reputation for his genius and patience in his search for the truth and the results are too well known to require comment. It is altogether fitting that the country which has produced a Schott and a Winkelmann should rally its technologists and scientists to pursue their work with the same spirit of devotion for the betterment of their own industry, their country and the world at large.

It is also gratifying that the society is intended to be an independent organization. In spite of the fact that the ceramic industry has certain interests in common with the glass industry, their problems are of an altogether different nature. In organizations embracing both industries it is usually the glass industry which suffers from neglect. It is understood, of course, that this state of affairs is due to the fact that the glassmakers are not sufficiently organized and are also lacking in numerical strength to form independent bodies, and that in union there should be strength. Nevertheless, if it is conceded that no man can serve two masters it is evident that no society can promote the best interests of two industries.

May the German Society of Glass Technology fulfill the hopes of its founders and may it be a potent factor in re-establishing the bonds of mutual respect which should exist between civilized nations.

Plans for the establishment of a national engineering museum at the Smithsonian Institute, Washington, D. C., the first of its kind in the United States, are announced by the American Society of Mechanical Engineers.

Standard Milk Bottles

By A. E. WILLIAMS*

In the manufacture of milk bottles today there is a great deal of useless expense caused by the lack of uniformity in the sizes and markings required by different state laws. With a view to eliminating this source of waste the Bureau of Standards is seeking to standardize the sizes and markings by mutual agreement among manufacturers and dairymen, and by legislation permitting the adoption of these standards all over the country. This legislation will give the Bureau of Standards the right to prescribe a standard for milk bottles even as it now does for weights and measures. The milk bottle has come to be regarded as a measure of capacity.

In all the states the maker of milk bottles is required by law to mold on the bottle a mark which will identify it as his and in some cases another showing that he has complied with the registration laws of the state in order that he may be held responsible for the correctness of its capacity. Each state has made its laws without reference to the laws of other states, with the result that all the laws differ in many respects.

The manufacturer's mark is usually different in different states, and for no particular reason. It simply happened that he was assigned one mark in one state and a different mark in another state. In some states also, he is required to put the "registered" mark above the dairyman's label and in others he is required to put it below. And the kind of marking is not the same in all states.

Moreover the sizes of bottles are not the same. One state requires a bottle to be filled to within a quarter of an inch of the cap while an adjoining state may require it to be filled entirely full. This difference is allowed for by making bottles of different capacity, so that one holds a quart when filled full and the other holds a quart when filled to within a quarter of an inch of the top. There are twenty-three sizes of caps in use today and the variety of bottles is equally great.

All this is a great source of expense. Bottles are made by machinery, at a rate of one every 2 or 3 seconds. Each bottle is blown into a mold, and this mold is made of steel with the necessary letters and markings carved into it by hand. The lack of uniformity in sizes and markings means that the manufacturer has to keep on hand a set of these expensive molds adapted to the laws of each state in which he does business, and the best he can do in the way of economy is to provide inserts for such features of the marking as must be changed. He must have different molds for different sizes.

If the filling laws were the same in all states; if the manufacturer's mark were the same; if the registration mark were the same in nature and location; then these things would be left unchanged from order to order and only the dairyman's label would have to be changed. And this would be an easy change to make. The label could be standardized as to size and a plate made for insertion into the mold on which could be engraved anything the dairyman desired.

As it is, the lack of uniformity results in a duplication of equipment and a higher cost of manufacturing for which the public has to pay in the form of an increased milk bill and from which no one gains anything. It is a price the milk men have to charge to cover a waste they are not allowed to avoid.

No state today would think of having a standard pound or yard which was different from that now kept at the Bureau of Standards. That pound and that yard are the standards for the entire country. In the same way it is proposed to have the Bureau of Standards establish certain sizes and marking of milk bottles as standard and to have these apply to the whole country.

Of course there might be a difference of opinion as to which sizes and markings it would be best to adopt. Where, as in most cases, this is purely a matter of preference, it is likely that the one adopted will be the one that has come into most general use. Where experiment can show any advantage of one over the other the one found best will be adopted. For example it is likely that bottles will not be required to be filled entirely full. When being filled by machinery the filling full causes a waste. If the standard filling is up to the cap some milk is spilled; if it is below the cap the purchaser gets what would otherwise be wasted. As the spilled milk has to be cleaned up it is a loss to the dairy as well. If the housewife gets a full bottle in one state and a bottle not quite full in another she is likely to think she is being cheated by the one that is not quite full. This, however, is due to a difference in state laws, and while she gets full value in both cases she is likely to get a little more than full value in the bottle whose filling mark is below the cap.

*United States Bureau of Standards.

Technical Consultation Service

THE GLASS INDUSTRY invites its readers to refer to this department any problems with which they may be confronted pertaining to raw materials, glass technology, laboratory and factory practice. While making no pretensions to the possession of unbounded knowledge or infallibility THE GLASS INDUSTRY is ready to assist its readers to the best of its ability in solving their problems. Readers who can offer better suggestions are invited to submit them.

Questions should be submitted in writing and will be answered by mail as promptly as possible. The sources of all inquiries will be held in strict confidence.

Question (38)—Suitability of Certain Sand for Glass Making.—Kindly advise whether the sand like sample enclosed would be satisfactory for glass-making.

Answer.—It is, of course, impossible to say definitely without an analysis whether the sand is suitable for glass manufacture, but judging from appearances we would say that the sand is well above the average in purity.

During an extended connection with the West Virginia Geological Survey, the writer had the opportunity of analyzing many glass sands and few of them were of better appearance than the sample you submitted. If the deposit is large it is probably valuable.—J. B. K.

Question (39)—Oil Finish on Crystal Arc Lamp Globes.—As one of your regular subscribers, we wish to take advantage of your technical consultation service. We wish to inquire what is meant by an "oil finish" on crystal arc lamp globes with which finish it is claimed that the globes can be cleaned much easier and specks from the carbon electrodes do not adhere so easily.

The question has come up in connection with ordinary circular crystal arc lamp globes becoming coated with a deposit which we believe is from the zinc of one of the electrodes, which specks are apparently cast off in all directions from the lower electrode and deposited on the inside of the globe; and it is noted that when the speck is removed it leaves a slight pit in the glass. These specks adhering to the glass are very objectionable and we have been informed that they could be removed by using a 90 per cent solution of muriatic acid; but somehow or other it seems to take the life out of the globes as only about 25 per cent of the globes that have been washed in this solution will stand again in ordinary use. We have been informed that a globe with what is known as an "oil finish" can be cleaned much easier and the specks do not adhere so easily. Any information as to this oil finish will be greatly appreciated.

Answer.—All of several glass men familiar for years with the manufacture of electric arc lamps, to whom this question was referred, reported entire ignorance of any such oil finish.

The only reference to the use of oil which might be called an "oil finish" was in connection with the annealing of small glass articles in vogue some years ago. At that time, in the manufacture of lamp chimneys, an oil bath was used for annealing purposes. The chimney was later washed in hot water to remove all traces of the oil.

In using the oil in connection with illuminating glassware, this would be out of the question for the reason that the oil finish readily collects dust and dirt which would render such glassware inefficient and impractical.

Can any reader supply further information?

Question (40)—Brashear's Formula—Where can I obtain Prof. John Brashear's formula for silvering mirrors?

Answer.—Brashear's formula was given in THE GLASS INDUSTRY, Vol. 2, No. 12 (December, 1921), page 291.

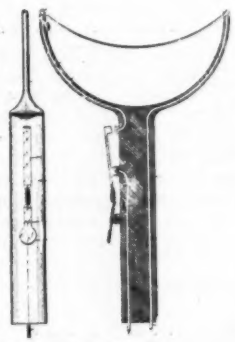
Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Copies of United States Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C. Price 10c each

Glass Cutter. U. S. 1,435,985. Nov. 21, 1922. John R. Scohy, of Okmulgee, Okla.

This invention has for its object to provide means for severing or cutting glass cylinders by means of a hot wire.



The handle of the apparatus may be formed of any suitable material such as fibre. The handle is provided with arms. Pins are located in the ends of the arms and are connected together by means of a resistance wire. The resistance wire is of such a length that when placed against a glass cylinder to be severed it will conform throughout the greater portion of its length to the curvature of the cylinder. The pins are connected to wires located within the arms and within the handle. The wires are connected to a source of current supply.

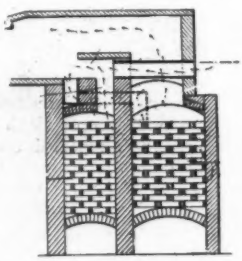
Glass-Finishing Tool. U. S. 1,436,825. Nov. 28, 1922. Andrew J. Sanford, of Newark, O., assignor to A. H. Heisey & Co., of Newark, O.

The invention relates particularly to that class of tools utilized in finshing cylindrical glassware, such as tumblers, vases, and similar articles, wherein the walls of the open end article are required to be thinned, and especially for use in eliminating the annular bead at the inner edge of tumblers formed during the process of making the tumbler.

To this end the invention consists essentially in certain novel combinations and arrangements of parts involving a pair of shaping or squeezing fingers for co-action on the walls of the cylindrical article to be thinned, and also in certain novel features of construction wherein a resilient pressure is accomplished and proper adjustment secured for reducing the plastic walls of the glass article to the required thickness.

Gas and Air Mixer for Glass Furnace. U. S. 1,438,842. Dec. 12, 1922. Emile Majot, of Barnesville, O.

The invention is an improvement upon that disclosed by a former Patent No. 1,273,171, granted July 23, 1918, and its primary object is to provide improved means for mixing preheated air with the combustible gas to form the combustible mixture whereby a relatively higher furnace temperature is attained, with the result that melting of the glass or the desired treatment of other substances contained within the furnace is effected or completed more rapidly, and with a substantial conservation of fuel.

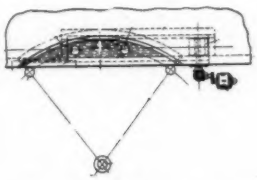


These features are particularly advantageous, the inventor claims, in connection with glass furnaces, as the batch is melted more rapidly than heretofore, thus enabling the filling of more batch than usual into the tank of the furnace, the resulting glass is of an improved quality, and the glass worker is afforded better facilities for working the glass and the amount of work required of him is reduced, thus conducing to the production of a higher grade of glassware.

The present invention provides a gas and air mixer for furnaces employed for various purposes, although it is particularly advantageous when used in conjunction with glass furnaces of the general type shown and described in the prior patent above noted and to which patent reference is made for a full and detailed disclosure of the complete furnace.

Glass Apparatus. U. S. 1,438,402. Dec. 12, 1922. John F. Rule, of Toledo, O. Assignor to the Owens Bottle Company, of Toledo, O.

This invention relates to means for gathering glass from a tank or supply of molten glass and for maintaining a circulation of the glass past the gathering point. At the present day the majority of the bottles made in this country and various other articles are made on Owens automatic machines in which the blank molds are brought serially into contact with the molten glass and gather by suction. In order to secure the required movement of glass past the gathering point, a large continuously rotating tank is provided, into which the glass flows from a melting or refining tank. The molds are successively brought over the rotary tank and lowered into contact with the molten glass to gather the charges. The use of such rotating tank involves a heavy expense, as a large amount of fuel is required.



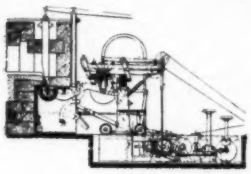
An object of the present invention is to provide practical means for circulating the glass at a gathering area in or communicating with the melting or refining tank, and so constructing and arranging the tank that the glass may be gathered directly from said area, thereby eliminating the rotary tank. The inventor claims that large saving of fuel is thus effected. A further economy in fuel is effected by reason of the fact that by gathering directly from the refining tank the glass therein can be at a substantially lower temperature than is required when it is run into an intermediate tank before being gathered in the molds. The elimination of the rotary tank also results in a substantial reduction in space that is otherwise required.

Glass-Finishing Machine. U. S. 1,436,878. Nov. 28, 1922. Augustus H. Heisey, of Newark, O., assignor to A. H. Heisey & Co., of Newark, O.

The invention relates particularly to that class of machines for finishing cylinder glassware, including tumblers and similar articles with open ends, for the purposes of thinning the material of the walls of the cylindrical article to a uniform thickness of predetermined dimensions and applying thereto a smooth and regular finish.

In the process of making the cylindrical article, as a tumbler, vase, etc., the glass may be either stuck on an iron punty or glass end on said punty, or the glass is caught in a snap device or holder to retain the cylinder in position for re-heating the material of the end that is to be finished or thinned out. During this process the glass article is retained in the finishing machine and thereby revolved a number of times in one direction, and then revolved an equal number of times in the reverse direction. During this movement of the glass the device of this invention is applied to the open end of the cylinder for uniformly thinning its walls and edges, and the forward and reverse movement of the cylindrical article, while in a heated condition and being operated upon, prevents the heated plastic material from running together, and insures a perfect, symmetrical article.

Machine or Apparatus for the Manufacture of Bottles and Other Blown Glassware. U. S. 1,438,665. Dec. 12, 1922. Emile Roirant, of St.-Ouen, France, assignor to Arthur Wilzin, of St.-Ouen, Seine, France.



This invention of improvements in or in connection with machinery or apparatus for the manufacture of bottles and other blown glassware, hereinafter comprised in the term bottles, has relation to the manufacture of bottles in or by automatic machinery or apparatus, and the invention has for its object to provide an installation of improved machinery or apparatus, and also machinery or apparatus by which it is possible to alter the duration of the contact of the glass with the parison mold and with the finishing mold and to make alteration in the duration of the glass contact with the finishing mold without affecting the other cyclical movements or phases of the machinery or apparatus.

Machinery or apparatus for the manufacture of bottles in accordance with this invention, comprises the combination of a glass melting furnace, a receptacle or container for molten glass, a glass shaping and blowing machine arranged in front of the receptacle or container and at a distance therefrom, a transporter for the molten glass, and means which automatically reciprocates the said transporter to and fro between the receptacle or container and the parison mold and also operates the molds and the valves of the glass shaping and blowing machine, said means operating the transporter and the molds and valves in correct functional co-relationship.

Process for Embellishing Glass. U. S. 1,437,131. Nov. 28, 1922. Percy Edward Correll, of Sydney, N. S. W., Australia.

The object of the present invention is to procure in the embellishment of sheet or plate glass novel artistic effects not hitherto obtainable by so-called glass "embossing," or by surface graining, or by other known methods.

In carrying out the invention, the whole or part of the rear surface of a sheet of transparent glass is "frosted" by sand-blasting or by grinding or otherwise, to produce a ground. Then upon the frosted ground surface a pattern is incised in reverse by deep sand-blasting to a depth of one fortieth of an inch more or less, using a resistant stencil as a guide. It is essential that the incised pattern shall have a frosted finish—this is attained by producing it by sand-blasting. The incised pattern thus produced may consist of letters or figures or of a diaper or other design, and appears to the eye as if it were of very substantially greater depth than it is in fact.

Glass Factory Equipment and Supplies

THE GLASS INDUSTRY will be glad to publish descriptions of new and useful devices, machinery and supplies of interest to the glass manufacturing trade. Most of the information printed in this department comes direct from the manufacturers of the products described.

New Small Vertical Belt Driven Air Compressor

A new line of small vertical belt driven air compressors known as Type Fifteen has been announced by the Ingersoll-Rand Company, 11 Broadway, New York. In addition to the plain belt drive design (Fig. 1) each size is built as a self-contained electric motor outfit, driven through pinion and internal gears as shown in Fig. 2, or by employing the short belt drive arrangement. The compressing end and electric motor of both gear and short belt drive units are furnished

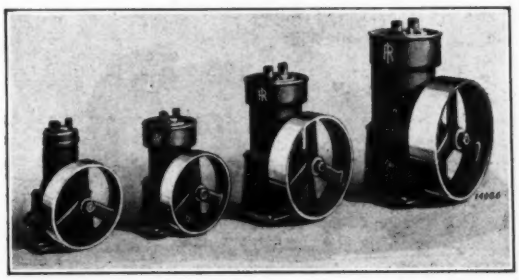


FIG. 1

mounted on a common sub-base, so that they are in no way dependent upon the foundation for correct alignment.

Several noteworthy features of construction have been incorporated, of which the "constant-level" lubrication system is the most important. Others include the constant speed unloader for plain belt drive machines; the centrifugal unloader for start and stop control machines; and the increased size of the water reservoir cooling pot.

The lubrication of small vertical compressors employing the enclosed crank case and splash system has often been a source of concern wherever oil in the air is a serious menace. The tendency of the old system has been to feed too much, resulting in discharged air containing excess oil, or too little, causing scored cylinders, excess loads and burned out bearings.

The manufacturers state that the "constant-level" system used in Type Fifteen compressors automatically maintains a constant-level of oil, which insures the right amount being distributed to all parts. As with the ordinary splash system, the base of the compressor forms an oil reservoir for the "constant-level" system. However, with this system, pet cocks determine the maximum and minimum amount of oil in the reservoir. Above this reservoir and directly underneath the connecting rod is a constant-level pan. Oil is pumped from the reservoir into this constant-level pan through a unique oil pump having no valves or other wearing parts. Regardless of the amount of oil in the reservoir, so long as it is somewhere between the high and low level pet cocks, this system, it is claimed, will function perfectly, insuring a constant-level of oil in the pan. A projecting stem on the connecting rod dips into this pan and distributes just a sufficient quantity of oil for proper lubrication.

The constant speed unloader controls the unloading of the compressor by automatically opening the inlet valve when the receiver pressure rises above that at which the unloader is set to operate. When the receiver pressure has fallen a predetermined amount, the unloader automatically releases the

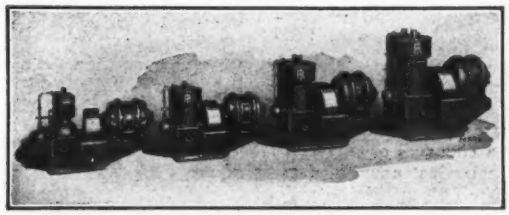


FIG. 2

inlet valve and allows the compressor to return to work and thus build up the receiver pressure again.

The centrifugal unloader allows the compressor to start under "no load" such as is essential when automatic start and stop control is used, and permits the electric driving motor to come up to full speed before the load is thrown on automatically. This unloader accomplishes its purpose by holding the inlet valve open until the motor has reached full speed.

The Glass World and What It Is Doing

News of the Industry

The German Society of Glass Technology[§]

A New Organization Announced

By DR. FRIEDRICH SPATE*

The German Ceramic Society has been in existence for a number of years in the interest of the German ceramic industry, but it has been impossible until now to found a similar organization for the German glass industry, which is of such great importance to Germany. For this reason the news of the establishment of the German Society of Glass Technology has been received with great satisfaction.

In the present difficult times of depression of the German political and economic life it must be the desire of everyone to counteract the political downfall of Germany by the greatest efforts in the field of technical science. The state institutions lack the means for further development and it is therefore a matter of much satisfaction that the wealthy Germany industry has in part taken over the continuation of scientific researches. In the industry the desire shows itself again to increase its output, to form combinations and societies in a similar manner as has been done by the German machinery industry when it founded the Society of German Engineers, which is probably unique in the world. Many similar societies have been formed since along the same lines, and again at the present time the desire to form such technical societies manifests itself. The object of these societies is generally the advancement of the industry, its technical development through the publication of scientific work and through the exchange of practical experience in meetings and technical journals.

Cooperation in the German glass industry is especially desirable, since during the past few years, mainly on account of the war, a number of new competitors have come into existence in foreign countries. The danger threatens that Germany will be surpassed in the field of glass technology and glass science, as it has occurred already in some branches of the glass industry. Reference is made to the Owens automatic machine and pyrex glass, and in recent years to the researches of Americans, especially on the physical properties of glass. In foreign countries great efforts are being made to further surpass Germany and to obviate their most important competitor. The foreign researches depend to a large extent on German preliminary studies; reference is made to the classical studies of Schott and his co-workers, which have laid the foundation of modern glass science and glass technology. For these reasons it would be all the more regrettable if Germany would ultimately lose the high rank which it occupies in this field.

The glass industry claims almost even more than the ceramic industry, especial interest as a "key-industry," glass science as a "key science," since glass is essential to many industries and to many branches of the natural sciences. It is only necessary to visit a chemical or physical laboratory to realize that without the many instruments of glass of the most varying composition the present high standing of both sciences would be impossible. The solution of the science of light is only possible through the use of glass. The development of the German glass industry, and therewith the assurance of its future, is the more important since the German glass industry is practically independent of other countries, as nearly all raw materials are obtainable within the limits of our land.

Although the present condition of the German glass industry cannot be considered as unfavorable, yet it is necessary to arm against the possibility of an unfavorable future. Then the German industry must be prepared; in other words, it may not work less efficiently than the glass industry of other countries. There is no question of the products of some of the foremost concerns which are practically without rivals in the world's markets due to the quality of their products. But there are glass works which do not stand on as high a plane of development as is desirable in their technical equipment and as regards their output. To a great extent these firms owe their large exports to the possibility of underselling foreign competition through the low price of the mark. For this reason and in order to guard against possible reverses it is necessary to prepare against future selling difficulties through high quality and low cost of production by developing the technical side of the whole German glass industry. With these objects in mind the German Society of Glass Technology has been organized and may the German glass works and the German glass makers combine to cooperative efforts with this purpose as a goal! The name of the society is "Society of Glass Technology"; from this it follows that it is to be a society which is not purely scientific but one in which the practical glass maker and the glass scientist work hand in hand. The purpose of the society must be scientifically founded practice and science applied to practical operation.

In spite of the large amount of investigation already done, there remain a great many unsolved problems in the field of glass technology and glass science. Every one who is or has been engaged in practical work in the glass industry knows that one is confronted almost daily with problems which cannot be solved in a purely empirical way and for which no scientific solution has been found. How often it happens that suddenly defects occur in glass which render the contents of a tank or a pot a total loss. And just as suddenly these troubles disappear without any one being able to explain their causes. Nothing had been changed in the batch, the melting and heating processes had apparently been normal. Or, suddenly a large amount of breakage occurs, in spite of careful cooling. In the mechanical manufacture of glass a thorough knowledge of the viscosity at high temperatures is important, and also the tendency to crystallize and the rate of crystallization. A wide field for the colloid chemist is that of colored and opaque glasses. What an opportunity presents itself in the study of glass with X-rays. Many a property of glass which is not understood today may find its explanation through this method.

One of the most important problems of technical glass science is the lowering of the cost of production while maintaining a good quality. From the results of analyses it can be seen how unnnecessarily expensive are the methods frequently employed. Glasses from two different factories which should serve the same purpose often show a marked difference in composition, especially in the amounts of alkalies, which form the most expensive cost item. In this connection the question arises to determine the proper batch composition for each purpose. This leads to the consideration of special glasses which are not mass production articles but which serve certain definite or scientific purposes. The manufacture of these glasses requires an exact knowledge of the physical properties of glass as a function of its chemical composition.

A sore spot in many glass factories is the question of decolorizing; there is scarcely any field in which so much haphazard experimentation is carried on, and yet the action of decolorizers depends on facts which are already partly understood.

The importance of scientific treatment of the question of heating has often been pointed out. How much there remains to be done may be realized when it is considered that in the present systems of heating the useful calorific effect is only from 10 to 20 per cent. Whoever understands the cost of production of glass and therewith the relation of the fuel cost to that of the finished article knows that often a slight modification in the method of operating gas producers or a small

§ Sprechsaal, Vol. 55, pp. 485-487. Translated for THE GLASS INDUSTRY.
*Chief of the Glass Research Laboratory of the Osram Works.

change in the construction of the producer can save large sums of money. Of great importance also is the right system of firing the furnace, partly in order to obtain a maximum temperature, *i. e.*, utilization of the heating power of the gas, and partly also with regard to the action of the flame on the glass. Among the matters for consideration before the German Society of Glass Technology must also be mentioned the question of search for raw materials in Nature and their uses in the glass industry. For the glass geologist there remains a large field of study of such deposits within our borders.

These are only a few important points which may be mentioned as examples to show the influence of scientific research in the field of the glass industry. The subject is therewith far from exhausted, but space does not permit the consideration of every question. It must be the main purpose of the society to bring the industry to a higher plane of development, through combined action of all those connected with the glass industry, whether as practical workers or as scientists. The value of the efforts of the non-scientific glass workers is not underestimated. It is they who have founded the industry. But it goes without saying that a scientific treatment of the knowledge gained by purely empirical methods, through a combination of practice and science, must further the development of the industry at a much greater rate. An example to show how fruitful can be such a combination is the development of the Jena glass works, which owe their world renown to a scientific treatment of the practice of glass-making. The importance of the practical worker remains. One of the purposes of the society must be to render it possible for the beginner to obtain a practical education during his studies. It is therefore desirable to establish chairs of glass technology at the universities.

Yet one more consideration may be mentioned which might cause many to doubt the possibility of existence of the German Society of Glass Technology. One who has worked for years on problems and who has finally succeeded in solving them, will not be inclined to publish the results of his long labors and cannot be expected to discuss his findings in meetings. The large sums which a firm spends for research work are for its own advancement. Real inventions, however, are always protected by patents and there are many questions of general technical and economical interest which can be discussed in public meetings. Reference is made to the methods of other societies; especially the discussions of the Society of Glass Technology of England are very interesting.

Hand Plants Resume Production This Month

The following companies to whom the wage scale will be issued will operate the second-period blast of 1922-23 for 18 weeks between January 29 and June 11, 1923:

	Pots.
Charleston Window Glass Co., Charleston, W. Va.	42
Clarksburg Glass Company, Clarksburg, W. Va.	36
Connelly Glass Company, Caney, Kans.	36
Eldred Window Glass Co., Punxsutawney, Pa.	42
Harding Glass Company, Fort Smith, Ark.	48
Houze Window Glass Co., Point Marion, Pa.	24
Ideal Window Glass Co., West Union, W. Va.	24
Indiana Window Glass Co., Vincennes, Ind.	30
Interstate Window Glass Co., No. 5, Huntington, W. Va.	60
Jeannete Window Glass Co., Point Marion, Pa.	30
Liberty Glass Co., Clarksburg, W. Va.	36
C. F. Lutes Glass Co., Hermosa Beach, Cal.	36
Marion Glass Co., Mannington, W. Va.	42
Masontown Glass Company, Masontown, Pa.	42
Model Glass Company, Fort Smith, Ark.	24
Modern Window Glass Co., Salem, W. Va.	36
National Glass Company, Shreveport, La.	42
National Sash & Door Co., Independence, Kans.	30
Paramount Window Glass Co., Salem, W. Va.	30
Penn Window Glass Co., Pennsboro, W. Va.	36
Premier Window Glass Co., No. 2, Marietta, Ohio.	36
Reliance Window Glass Co., DuBois, Pa.	30
Rolland Glass Company, Clarksburg, W. Va.	30
Royal Glass Company, Grafton, W. Va.	30
J. B. Scoby Glass Co., Sistersville, W. Va.	24
Torrance Window Glass Co., Torrance, Cal.	36
Victory Window Glass Co., Augusta, Kans.	33
Western Window Glass Co., Lovell, Wyo.	36
Total	981

Production Costs in Belgian Plate Glass Industry*

The distribution of costs of production in Belgian plate glass manufacture has been subject to some modification during the past year, particularly as far as furnace and shop labor and fuel costs are concerned, though melting pot material costs have not been appreciably reduced owing to the premium on French exchange, as French clay is generally used in pot manufacture. Staple raw materials, on the other hand, with the exception of excelsior and shavings for packing purposes, were at the beginning of the current year about 25 per cent cheaper than early in 1921. The result has been a notable increase in the relative importance of the labor factor in plate glass production costs.

On the basis of the current 1914 wage, the present wage index varies according to class of help between 475 and 510. For an 8-hour day, charge-mixers now receive 23.29 to 24.70 francs; rollers, 23.48 to 24.23 francs; cutters, 24.70 to 24.80 francs; polishers, 22.23 to 25.65 francs, and unskilled labor, about 22.33 francs.

An individual melting pot still costs from 350 to 475 francs, in which clay costs enter to the extent of about 135 francs. Wages in the refractory divisions show an increased minimum, as they now vary between 27.55 and 30.17 francs daily.

Cut Glass Manufacturers Meeting

The annual meeting of the National Association of Cut Glass Manufacturers at Philadelphia on December 4, 1922, was called to order in the morning by the president, G. Wm. Sell. Fifteen members were present. Directors for 1923 were elected as follows: O. S. Atterholt, Arthur Blackmer, Victor Brisbois, W. E. Corcoran, Raymond H. Fender, Emil F. Kupfer, Robert A. May, J. J. McKenna, F. L. Morecroft, J. J. Niland, G. Wm. Sell, Geo. E. Sherman, Thos. Skinner, T. P. Strittmatter, C. Strunk, Chas. H. Taylor, D. C. Tracy.

It was decided that the terms for 1923 business would be 1 per cent 15 days, 30 days net; all shipments f. o. b. factory.

The question of the possibility of a reduction in the prices of blanks was brought up and the blank manufacturers gave assurances that the prices of heavy blanks would be the same until next July.

The question of the lightware cutters becoming associated with the Association was brought up and it was decided that the president meet the committee of the lightware cutters and formulate a plan for them to join.

Preceding the annual meeting, the board of managers met, those present being G. Wm. Sell, chairman; Thos. P. Strittmatter, D. C. Tracy, Thos. Skinner, J. F. Rothfus, A. Fischer, R. H. Fender.

In the afternoon the directors met and elected for 1923 the following officers: G. Wm. Sell, president; D. C. Tracy, vice-president; R. H. Fender, secretary; Thos. P. Strittmatter, treasurer. R. A. May and Thos. Skinner were appointed to act with the officers to constitute the board of managers.

The time and place for the mid-Summer meeting was left to the call of the president.

The customary banquet was served on Monday evening and Dr. E. J. Cattel and Mr. Horn were the speakers.

Glass Experts for Tariff Commission

The intention of the United States Tariff Commission to appoint two special experts for work on the glass schedule is confirmed by John F. Bethune, secretary of the Commission, Washington, D. C., who states that the work relates to questions of competition between domestic and foreign products in the market, and conditions and costs of production at home and abroad.

Two experts will be required for the work, one with scientific training and experience in glass manufacture, and one with commercial experience in the variety of foreign and domestic products which come in competition. The latter should have the necessary education to collect and assemble data on competitive prices, and be able to analyze his findings and express them in his reports in good English.

*Reported November 18, 1922, by S. H. Cross, acting Commercial Attache, Brussels, Belgium.

Libbey-Owens Annual Report

The annual report of the business and operations of the Libbey-Owens Sheet Glass Company submitted to the stockholders at Toledo, O., on December 13, by E. D. Libbey, president of the company, showed a very satisfactory record for the year ended September 30, 1922.

Net earnings after deduction of federal taxes were $1,719,726. Total income of the company was placed at $2,571,420, with taxes estimated at $230,000. During the year the company paid off bank loans and notes aggregating $1,350,000 contracted during the lean year of 1920-1921. Cash dividends were paid amounting to $300,000 on a 6 per cent basis on outstanding $5,000,000 common stock and $140,000 on $2,000,000 of 7 per cent preferred. The company has cash balance of $951,804 and surplus of $2,175,868.

The officers for the ensuing year are: E. D. Libbey, president; M. J. Owens, vice-president; J. C. Blair, vice-president and general manager; B. C. Root, vice-president and assistant general manager; A. E. Fowle, vice-president and treasurer; H. E. Allen, vice-president and foreign manager; C. J. Wilcox, secretary; T. P. Geoghegan, general sales manager; T. C. McKinley, general factory manager; O. P. Walker, auditor.

The directors are: J. C. Blair, W. H. Boshart, A. E. Fowle, E. D. Libbey, M. J. Owens, B. C. Root and C. A. Schmettau.

During the year two of the furnaces in the company's Charleston plant were reconstructed to supply glass for two drawing machines each instead of one. This resulted, especially with the second installation, in very great fuel economy and further improvements of this kind will be made.

Despite interruptions due to rebuilding furnaces and to a fire which necessitated a temporary suspension of operations in several furnaces, the factory was operated to only about 75 per cent of capacity over the period of the year. A purchase of ten acres of land was recently made at Charleston upon which dwelling houses for employees will be erected as needed. The president reported that the demand for flat drawn sheet glass continues to exceed the company's capacity for production.

Progress in the extension of the Libbey-Owens process was reported. The Canadian Libbey-Owens Sheet Glass Company, Ltd., of Hamilton, Ont., has readily disposed of its product since beginning operation on November 3, 1921, and is considering increasing its present installation of two machines to four.

In Japan, owing to the serious business depression, the American-Japan Sheet Glass Company, in which the Libbey-Owens Sheet Glass Company has a substantial stock interest, has had to contend with financial difficulties, but the Sumitow group, one of the strong financial groups of Japan, has assumed the management of the company and will supply it with the necessary funds and a successful year is anticipated.

Two machines began operations in June, 1922, at the Shreveport, La., plant of the United States Sheet & Window Glass Company, and two more in September. The remaining two machines will be placed in operation during the winter. All machines in this plant are installed two to a furnace and an abundant supply of cheap natural gas is available.

One machine has been in operation since May 1, at the Fairfield Sheet Glass Company, Lancaster, O.

The Toledo Libbey-Owens Sheet Glass Company has been organized to build and operate a six-machine plant at Toledo, O., but construction has been postponed on account of increase in the cost of building and equipment and pending the outcome of several experiments that are being worked out.

Progress in introducing the Libbey-Owens process into Europe is reported. A company has been organized in Belgium to build a two-machine plant and construction work will proceed immediately. A similar arrangement has been made for a one-machine plant in Switzerland. A two-machine plant will be built at once in southern France by a group of French bankers and glass manufacturers to be followed by the erection of a four-machine plant in northern France.

The first unit of two machines and one furnace at Moll, about 30 miles from Antwerp, Belgium, is rapidly nearing completion. The entire installation will consist of six machines.

The Owens Bottle Company Expands Factories

The Owens Bottle Company with general offices at Toledo, O., have announced a rather pretentious building program which will give them additional capacity and improve their methods of operation.

At Toledo a new mold shop will be built, to be a story and one-half high of saw-tooth brick and steel construction. This shop will be 120 ft. wide by 291 ft. long. This building will house the mold shop proper with office, drafting room, pattern shop and storage space. All the foundations are now in place.

The program at Charleston calls for an extension to the main bottle manufacturing plant. This will be two stories high, 120 ft. by 130 ft., and will provide space for new furnaces and two additional bottle machines. The lehr room will be extended 120 ft. by 123 ft. An addition to the Charleston warehouse of one-story saw-tooth construction 280 ft. by 481 ft. will be made and an addition will be made to the office and warehouse 95 ft. by 177 ft. All of these buildings will be of concrete, brick and steel construction. Foundations are now under way.

The new Fairmont warehouse, 150 ft. by 470 ft. by 114 ft., will be one story high, of concrete, steel, and corrugated iron construction.

The DeVore Co. of Toledo, O., are the engineers in charge of these new buildings.

American Ceramic Society Meeting

The Twenty-Fifth Annual Meeting of the American Ceramic Society will be held at Pittsburgh, Pa., February 12 to 16, 1923. Many interesting and instructive papers on ceramic subjects will be presented and discussed. An exhibit of ceramic objects has been planned to show the progress of the art during the past quarter century. A large attendance of members interested in the various branches of the industry is expected.

Professor Silverman to Lecture on Glass

Professor Alexander Silverman, head of the Department of Chemistry in the University of Pittsburgh, will deliver the first lecture of a new series on "Popular Science," which has been arranged by Director Douglas Stewart of the Carnegie Institute. The opening lecture on "Glass Throughout the Ages," will be a fully illustrated story of glass making since ancient times, and is scheduled for the evening of January 9th in Carnegie Lecture Hall, Pittsburgh. Exhibits from the Carnegie Museum, manufactures of commercial and art glass, and Professor Silverman's private collection will be shown.

Admission is free but application for tickets should be made in advance to Douglas Stewart, Director of Museum, Carnegie Institute, Schenley Park, Pittsburgh.

Ball Brothers Incorporate New Company

Articles of incorporation for Ball Brothers Company, which is expected to take over the business of Ball Brothers Glass Manufacturing Company, Muncie, Ind., were filed with the secretary of state on December 19. G. A. Ball, treasurer of Ball Brothers Glass Manufacturing Company, announced that the new company will be capitalized at $10,000,000, with $5,000,000 of preferred stock. E. Arthur Ball and William H. Ball, both of Muncie, and Arthur W. Brady are named as directors of the new company.

New Pittsburgh Plate Glass Plant

Late in November the Pittsburgh Plate Glass Company, through W. L. Clause, chairman of the board of directors, announced to its stockholders its intention of erecting a new plate glass plant at Creighton, Pa. This plant when completed will have a capacity of from fifteen million to twenty million feet annual production. It will be erected in sections for the purpose of getting increased production at the earliest possible moment, and work thereon is already under way. The processes to be installed in this plant will be revolutionary, and a complete departure from the standard processes in use

either in this country or in Europe. The plant when completed will have a capacity equal to a third of the present production of the company, with the probability that it will ultimately equal a half of it.

The company has just completed extensions at Kokomo, Ind., which have doubled the capacity there, and the additional production is just coming into the market. In addition to this it has decided to temporarily bring the entire production of its Belgium plant to this country in an endeavor to meet the existing demand.

Verified News of Trade Activities

The Jefferson Glass Company, Follansbee, W. Va., capitalized for $100,000 has recently increased the capitalization to $500,000. An issue of $150,000, 7% cumulative preferred stock will be put on the market January 1. Part of this sum will be spent in enlarging the plant and increasing production.

The last remaining assets of the **Kane Window Glass Company** consisting of some oil and gas property located at Kane, Pa., were merged with some other gasoline and oil and gas producing properties under the name of the Sloan and Zook Company, with principal offices at 101 Main street, Bradford, Pa.

At a stockholders' meeting of the Ford Glass Company, Toledo, O., it was announced by the president, George Ford, that Factory No. 1, at Rossford, O., would be rebuilt and equipped with modern machinery. An increase in the company's capital stock will be made to take care of the improvements.

At the annual meeting of the National Glass Distributors' Association held at Pittsburgh, Pa., on December 6, the following officers were elected: C. W. Condie, president; E. V. Jacka, vice-president; North Storms, secretary-treasurer. The board of directors consists of R. B. Tucker of Norfolk, Va.; Thomas C. Edwards of New York, S. S. Foote of Baltimore, John N. Carey of Indianapolis, A. E. Clerihew of Minneapolis, A. R. Dole of Chicago, S. C. Gilmore of Philadelphia, L. A. Hippach of Chicago, E. V. Jacka of New York, C. W. Kendle of Louisville, W. J. Schoonover of Scranton, D. H. Startsman of Cincinnati and H. A. Wheeler of Boston. The speakers at a morning session which closed with a noon luncheon given by the American Window Glass Company were W. L. Clause, W. L. Monro and D. K. Albright.

The installation of a clean gas producer plant which the **Smith Gas Engineering Company,** of Dayton, O., had contracted to furnish for the Ford Motor Company's glasshouse which was originally planned to be erected at Flat Rock, Mich., will be installed at the Highland Park plant as an addition to the large amount of equipment already in operation there. When it was decided to erect the new glass factory at River Rouge instead of at Flat Rock the determination was made to use coke oven gas instead of producer gas, and no producer plant will be required at River Rouge.

Personal News

H. L. Dixon, president of the H. L. Dixon Company, Pittsburgh, Pa., accompanied by Mrs. Dixon, is making an extended visit on business and pleasure to England, Germany, Switzerland, France, Belgium, Italy, Egypt and other countries.

Joseph Volkommer of the Vitro Manufacturing Company, Bessemer Building, Pittsburgh, Pa., has returned from a three-months' visit to Europe.

Trade Publications

Wood Automatic Gas Producers.—A 32-page catalog issued by R. D. Wood & Co., 400 Chestnut street, Philadelphia, Pa., describing and illustrating the Wood Automatic Heavy-Duty and the Wood Automatic "M C" type Gas Producers. The construction of these well-known producers and the principles upon which they operate are clearly shown.

Oil Burning.—A booklet published by the National Airoil Burner Co., Ninth and Thompson streets, Philadelphia, Pa., in which is described their "Airoil" burner. This burner is of the internal steam atomizing type but differs, it is said, in every feature of its construction from other burners of the same type. The makers state that the special advantages claimed for their device have been amply demonstrated over a long period and on a large scale in glasshouses, boiler plants, metallurgical works, etc.

Deaths

William A. Sargeant

William A. Sargeant, general manager of the Consolidated Lamp & Glass Company, Coraopolis, Pa., died on December 2, while on a visit to Beallsville, O. Mr. Sargeant, who was 54 years old, had been connected with the Consolidated company at Coraopolis for the past 27 years, going there from Fostoria, O.

John Nixon

John Nixon, manager of the New York branch of the Fostoria Glass Company, Moundsville, W. Va., was struck and killed by a train while crossing the tracks to reach a train for New York at the East Orange, N. J., station.

Stock Quotations

(Reported by Moore, Leonard & Lynch, Frick Building, Pittsburgh, Pa.)

PITTSBURGH STOCK EXCHANGE, DEC. 21, 1922

	Bid	Asked	Last
American Window Glass Machine, com...	84	85	85
American Window Glass Machine, pfd....	91	93	93
American Window Glass, Preferred.....	107	..	107
Pittsburgh Plate Glass	..	200	198
U. S. Glass	..	45	46

A rather quiet market has prevailed during the past month, the only issue showing any exceptional strength being Pittsburgh Plate Glass. The other issues have maintained an even tone and U. S. Glass has been especially inactive. From a market standpoint U. S. Glass demonstrates a sagging tendency. There is reported to be very substantial buying in American Window Glass Machine common, and this demand is based upon the fact that the company is said to be doing the largest business in its career. It was recently reported that American Window Glass shipped 567 car loads of window glass in the last four weeks. This is the largest amount of window glass ever shipped by that company in a similar period. The outlook for the glass industry for the next twelve months appears very favorable and there is every reason to believe that with continued profitable operations for the companies, the better grade of stocks will reach higher price levels.

WHEELING STOCK EXCHANGE, DEC. 21, 1922

	Bid	Asked	Last
Hazel-Atlas	156	158	160
Imperial Glass	98	110	98
Fostoria Glass	120	...	120
Central Glass	95	105	100

The Wheeling Glass stocks have been characterized mainly by their inactivity. Hazel-Atlas is offered at 108 ex-dividend and the last sale shown above at 160 took place while the stock still carried the dividend. There is reported to be a good demand for Imperial and the stock has developed a slight upward tendency that will probably be continued if operations of the company keep up at the present rate. Central Glass recently resumed dividends and the rate now carried by the stock is 4% annually, being disbursed 1% each quarter. The outlook for the glass market is exceedingly attractive.

TOLEDO STOCK EXCHANGE, DEC. 21, 1922

	Bid	Asked	Last
Owens Bottle Machine, common.....	35¾	36¾	36
Owens Bottle, preferred	..	114	110¼
Libbey-Owens Sheet Glass, common....	108	115	108
Libbey-Owens Sheet Glass, preferred...	104	108	106½

Inquiries Received

For further information address THE GLASS INDUSTRY

102.—We are interested in an electrical appliance to pull our lehrs, also all available information on the use of oil in place of natural gas.

103.—Will you kindly give me the address of some reliable glass works that can furnish neckless glass tubes or vials to be used as containers for chemical products.

104.—(From Germany.) We should like the names of manufacturers of tube drawing machines for glass; also manufacturers of woodworking machines for the making of turned wooden boxes.

105.—We intend to purchase a draft gauge to be connected to our window glass tank. Kindly send manufacturers' addresses.

Current Prices of Glass-Making Materials

From quotations furnished by various manufacturers and dealers

December 23, 1922

	Carlots	Less Carlots
Aluminum hydrate ($Al(OH)_3$)..lb.	.05	.05½
Aluminum oxide (Al_2O_3).....lb.	.05½	.06½-.07
Antimony oxide (Sb_2O_3).. ...lb.	.07-.08	.08-.10
Arsenic trioxide (dense white), 99% (As_2O_3).....lb.	.13-.13½	.13½-.14
Barium carbonate ($BaCO_3$)...ton	75.00	90.00
Barium hydrate ($Ba(OH)_2$)....lb.	.05½	.05½
Bone ash .....lb.	.05	.06
Borax ($Na_2B_4O_7 10H_2O$) .....lb.	.05½	.06
Borax, fused, any mesh ($Na_2B_4O_7$) .....lb.	.19	.20
Boric acid, fused (B_2O_3).....lb.	.35	.35
Cadmium Sulphide, red (CdS)..lb.	..	1.65
Cadmium Sulphide, orange.....lb.	..	1.65
Cadmium Sulphide, yellow (CdS) .....lb.	..	1.90
Chrome oxide .....lb.	.34	..
Cobalt oxide, in bbls. (Co_2O_3)...lb.	..	2.10
Cobalt oxide, in 10 lb. tins (Co_2O_3) .....lb	..	2.20
Copper oxide, red .....lb.	..	.15-.16
Copper oxide, black (CuO).....lb.	..	.26
Copper oxide, black prep'd (CuO) .....lb.	..	.30
Cryolite (Na_3AlF_6) .....lb.	..	.09½
Feldspar, 100 mesh.....ton	15.00	25.00
Fluorspar, powdered white, 95% (CaF_2) .....ton	35.00	45.00
Fluorspar, powdered white, 90% (CaF_2) .....ton	33.00	38.00
Hydrofluoric acid (HF) 60%..lb.	.13	..
Kaolin .....ton	17.00	25.00
Lead oxide (red lead) (Pb_3O_4)..lb.	.10½	.10¾
Litharge (PbO) .....lb.	.09 4/5	.10¼
Lime—		
Hydrated (in 50 lb. paper sacks) ($Ca(OH)_2$) .....ton	11.50	..
Burnt, ground, in bulk (CaO).ton	8.00	..
Burnt, ground, in paper sacks.ton	10.00	..
Burnt, ground in 280 lb. bbls. per bbl.	2.10	2.25
Manganese 85% (MnO_2).....lb.	.03¾	.04¼-.06
Nickel oxide, black (Ni_2O_3) for nickel content .....lb.	..	.50
Nickel monoxide, green (NiO) for nickel content.....lb.	..	.50
Potassium carbonate—		
Calcined 90% (K_2CO_3).....lb.	.06¼	.06½
Hydrated 90% (KOH) .....lb.	.06½	.07¾
Potassium nitrate (KNO_3) (gran.) .....lb.	.06½	.06¾
Powdered blue .....lb.	..	.26-.30
Powdered blue (std. formula)..lb.	..	.38
Salt cake, glassmakers, f. o. b. works (Na_2SO_4) .....ton	21.00	26.00-30.00
Selenium (Se) .....lb.	..	1.95.-2.25
Soda ash, 58% dense, 48% basis Bulk (Na_2CO_3) .....100 lb.	1.22½	..
Bulk, on contract (Na_2CO_3) 100 lb.	1.17½	..
Sodium nitrate, refined ($NaNO_3$).lb.	..	.04¾-.06¼
Sodium selenite (Na_2SeO_3).....lb.	..	2.35-3.00
Sodium Fluosilicate (Na_2SiF_6)...lb.	.07¾	.08
Sulphur (S) (flowers)—in bbls. per 100 lb.	3.25	3.55-3.80
Sulphur (flowers) Bags per 100 lb.	3.00	3.30-3.55
Sulphur (S) (flour, heavy), in bbls. per 100 lb.	2.50	3.00
Uranium oxide—100 lb. lots (UO_2) .....lb.	..	2.25-2.50
Zinc oxide (ZnO) .....lb.	.07¼	.07½

Monthly Summary of United States Foreign Commerce in Glass

Corrected to November 29, 1922

[NOTE: Only the exports of domestic merchandise are published at this time, on account of delay in the import reports. The corresponding statement of imports will be published when the delayed reports are received.

Owing to the great number of defective entries filed with collectors of customs since September 22, which failed to show the information required by the new tariff law and the revised statistical schedule, the compilation of imports under the new tariff from September 22 to October 31, 1922, is proceeding very slowly.]

EXPORTS

	October 1921 Quantity	October 1921 Value	October 1922 Quantity	October 1922 Value	Ten Months Ending October 1921 Quantity	Ten Months Ending October 1921 Value	Ten Months Ending October 1922 Quantity	Ten Months Ending October 1922 Value
Glass and glass products (total).....	.....	$682,262	.....	$770,771	.....	$12,859,176	.....	$7,067,306
Plate and window glass—								
Window glass, common, box, 50 sq. ft.....	1,895	$11,500	3,226	$17,332	55,884	$441,764	28,796	$153,567
Plate glass, unsilvered, sq. ft.....	72,541	49,084	204,063	83,843	1,927,715	1,174,938	2,208,137	947,450
Wire glass, sq. ft.....	.....	.....	18,312	5,555	.....	.....	207,116	55,447
Other window and plate glass, n. e. s.....lbs.	.....	.....	202,191	25,749	.....	.....	1,624,119	187,525
Glass containers (bottles, vials and jars).....lbs.	.....	171,525	4,268,043	208,068	.....	4,161,104	34,475,638	1,877,699
Table glassware, plain.....lbs.	.....	.....	1,521,516	173,278	.....	.....	10,319,141	1,140,298
Table and other glassware, cut or engraved....lbs.	.....	14,092	55,224	19,027	.....	160,790	367,684	137,160
Glassware for lighting—								
Lamp chimneys and lantern globes.....lbs.	.....	.....	108,185	19,351	.....	.....	1,162,852	237,878
Globes and shades for lighting fixtures.....lbs.	.....	.....	120,111	40,089	.....	.....	1,226,725	354,186
Lamps and other illuminating devices, chiefly of glass .....lbs.	.....	.....	72,436	25,426	.....	.....	898,760	318,158
Chemical glassware .....lbs.	.....	13,594	16,009	12,114	.....	202,662	237,845	129,889
Electrical glassware, except for lighting.....lbs.	.....	.....	224,989	15,976	.....	.....	1,835,882	140,035
Other glassware, n. e. s.....lbs.	.....	422,467	691,433	124,963	.....	6,717,978	10,805,003	1,388,014